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Hydroxy Trace Minerals: A Smart Solution for Greener and More Productive Livestock Farming

Mundrathi Harika^{*1}, Jupelli Uma Maheshwar Rao², Akshat Kaushik³

¹ Ph. D Scholar, Department of Livestock Production Management, College of Veterinary Science, PVNRTVU, Hyderabad, Telangana.

²Ph. D Scholar, ICAR-Directorate of Poultry Research, Rajendranagar, Hyderabad, Telangana.

³Ph. D Scholar, Department of Livestock Production Management, CoVSc. & AH. DUVASU, Mathura.

Corresponding author email: harikamundrathi07@gmail.com

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Key Points

- Hydroxy trace minerals (HTMs) provide higher bioavailability and greater stability than conventional mineral supplements, improving mineral absorption and nutrient utilization in livestock and poultry.
- Supplementation with HTMs enhances growth, immunity, reproduction, feed efficiency, and overall productivity across dairy cattle, beef cattle, calves, poultry, and swine.
- By improving nutrient efficiency and reducing mineral wastage, hydroxy trace minerals support sustainable livestock production and help lower the environmental footprint, including methane emissions.

Abstract

As the livestock sector continues to expand to meet the growing demand for animal products, concerns about its environmental impact have also increased. Livestock production contributes significantly to greenhouse gas emissions, particularly methane released during digestion in ruminants. Scientists and nutritionists are therefore exploring innovative feeding strategies that can improve animal productivity while reducing environmental pollution. One such promising advancement is the use of hydroxy trace minerals (HTMs) in animal nutrition.

Introduction

Hydroxy trace minerals are a new generation of mineral supplements produced by reacting mineral elements with alkali to form a hydrolysed inorganic metal complex. Unlike conventional inorganic mineral salts such as sulphates, hydroxy trace minerals possess a stable crystalline structure in which the mineral ions are held together by strong covalent bonds.

This unique structure protects the minerals from unwanted chemical reactions inside



the digestive tract, making them more available for absorption by the animal. As a result, hydroxy trace minerals combine the advantages of high bioavailability with moderate cost, making them an attractive alternative to traditional mineral sources.

Why Are They Different?

The major difference between hydroxy trace minerals and conventional inorganic or organic mineral sources lies in their stability. Their crystalline structure allows them to remain relatively insoluble under neutral conditions, such as those found in the rumen of cattle and sheep, but they dissolve readily in the acidic environment of the stomach and small intestine. This property prevents premature interactions with other dietary components, allowing a greater proportion of the mineral to reach the site where absorption occurs.

A Step Towards Reducing Methane Emissions

Methane is one of the most potent greenhouse gases produced during rumen fermentation. Although trace minerals themselves do not directly eliminate methane production, hydroxy trace minerals improve rumen efficiency by reducing undesirable mineral interactions and enhancing nutrient utilization.

Because these minerals bypass the rumen without excessive dissolution, they are absorbed more efficiently in the intestine. Better mineral utilization improves feed efficiency and animal performance, thereby lowering greenhouse gas emissions and reducing the carbon footprint associated with livestock production.

Better Mineral Availability

The effectiveness of any mineral supplement depends largely on its bioavailability—the proportion of the consumed mineral that is actually absorbed and utilized by the animal. Studies have shown that hydroxy copper, zinc and manganese exhibit lower solubility in the rumen than their sulphate counterparts but dissolve efficiently under acidic conditions. This minimizes losses caused by interactions with antagonistic compounds such as molybdenum and sulphur, allowing more minerals to become available for metabolism.

Researchers have also reported that hydroxy copper provides greater bioavailability than copper sulphate in cattle consuming diets rich in copper antagonists. Similar improvements have been observed for zinc and manganese.

Benefits Across Different Animal Species

Calves

Supplementing milk replacers with hydroxy trace minerals has been associated with improved feed intake, higher dry matter consumption, stronger immune responses and better antioxidant status. Calves receiving these minerals also showed fewer cases of diarrhoea,

required less medication and demonstrated improved growth.

Dairy Cattle

Research indicates that cows receiving hydroxy trace minerals during the transition period maintain better body weight and consume more feed than animals receiving conventional sulphate minerals. Improved antioxidant status also suggests enhanced resistance to metabolic stress.

Beef Cattle

Studies on growing steers have demonstrated that hydroxy copper and zinc are efficiently absorbed and can be fed at lower dietary levels without compromising growth performance, carcass quality or liver mineral status.

Poultry

In laying hens, hydroxy trace minerals have reduced the number of cracked eggs while increasing mineral concentration in egg yolks. Broiler chickens supplemented with hydroxy trace minerals have shown superior weight gain and greater resistance to oxidative stress, resulting in improved overall performance.

Swine

Hydroxy copper and zinc supplementation has improved sow productivity by increasing litter weight, piglet growth, milk protein content and antioxidant enzyme activity. These improvements contribute to healthier piglets and better reproductive performance.

Economic Advantages

Besides improving animal health and productivity, hydroxy trace minerals also offer economic benefits. Their cost is generally comparable to inorganic mineral sources but considerably lower than many organic mineral supplements. Improved nutrient utilization further reduces mineral wastage, making them a cost-effective option for farmers.

Supporting Sustainable Livestock Production

Modern livestock farming aims to produce more food using fewer resources while minimizing environmental impact. Hydroxy trace minerals fit well into this goal by improving nutrient efficiency, supporting animal health and helping reduce greenhouse gas emissions associated with livestock production.

Although additional research is continuing across different production systems, the evidence available so far suggests that hydroxy trace minerals represent an important advancement in sustainable animal nutrition.

Conclusion

Hydroxy trace minerals are emerging as an effective alternative to conventional mineral

supplements in livestock and poultry production. Their superior stability, higher bioavailability and improved nutrient utilization enhance animal health, growth, reproduction and productivity. At the same time, they contribute to better feed efficiency and lower methane emissions, supporting efforts to reduce the carbon footprint of animal agriculture.

As the livestock industry moves toward more sustainable production systems, hydroxy trace minerals are likely to play an increasingly important role in achieving both economic profitability and environmental sustainability.